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### Telecommunication System (T/C) Malfunction Symptoms 1 - 12 + Hand drawn diagrams (Apollo Operations Handbook)

National Aeronautics and Space Administration (NASA)

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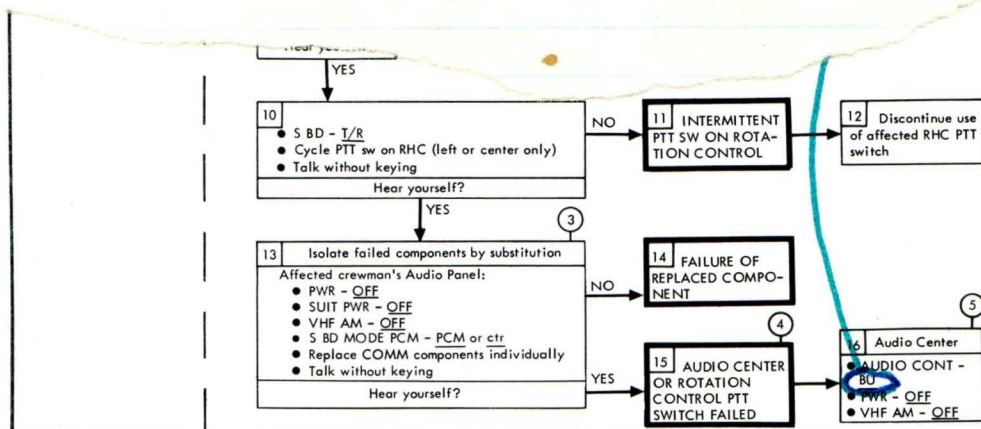
#### Recommended Citation

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COMM	OLD NO	lines	NEW NO.	PAGE
ONE crewman has intercom	1		1	} 1
Loss of intercom	2		2	
Unselected Hot Mike	3		3	
Loss of VHF Comm (MSFN within VHF Range)	4		4	2
Loss of VHF Comm with LM (MSFN not within VHF Range)	5		5	3
Loss of S band <sup>Voice</sup> Comm (MSFN not within VHF Range)	6	1 1/2 pg.	7	5-6
Loss of S band Voice Comm (MSFN within VHF Range)	7	1 pg	6	4
MSFN Reports Loss of Ranging	8	2L	8	6
MSFN Reports loss of PCM	9	2L	9	6
Cannot Acquire Phase lock with Omnie	10	89	12	7
HGA does not respond Properly to <del>then</del> Pending Chds	11	3L	10	6
Cannot Acquire Phase lock with HGA	12	6L	11	7



Selecting the alternate Audio Center is necessary to avoid the HOT MIKE conditions and continuous S BD voice transmissions regardless of the position of the Audio Center S BD switch.

③ Procedure removes all power from CCU.

④ The Audio Center is still usable in the hot mike mode; undesired air-to-ground transmissions can be eliminated by placing the Audio Center S BD and VHF switches to OFF or RCV.

⑤ The PTT sw of affected crewman will be inoperative.

SM2A-03-SC104-(2)  
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
1 ONE CREWMAN HAS NO INTERCOM CAPABILITY	<p>1 Audio Center • MODE - alternate positions Intercom any mode?</p> <p>2 If failed mode is - INTERCOM/PTT PTT VOX</p> <p>3 MODE SWITCH CIRCUIT FAILED</p> <p>4 PTT KEYING CIRCUIT FAILED</p> <p>5 VOX KEYING CIRCUIT FAILED</p> <p>6 Audio Center • AUDIO CONT - BU Intercom?</p> <p>7 Backup intercom • PAD COMM (3) - T/R • AUDIO CONT - NORM Communication between crewmen returned?</p> <p>8 INTERCOM DIODE SWITCH FAILED</p> <p>9 AUDIO CENTER FAILED</p> <p>10 Use backup Audio Center • AUDIO CONT - BU • PAD COMM (3) - OFF</p> <p>11 Isolate failed components by substitution Affected crewman's Audio Panel: • PWR - OFF • SUIT PWR - OFF • VHF AM - OFF • S BD MODE PCM - PCM or ctr • AUDIO CONT - NORM Replace COMM components individually</p> <p>12 FAILURE OF REPLACED COMPONENT</p>	<p>1 (Center audio center only) verify S BD NORM MODE VOICE - not in RELAY.</p> <p>2 Procedure removes all power from CCU.</p> <p>3 No hot mike intercom available. S BD or VHF AM sidetone may be used as a backup intercom. PAD COMM will be 10 times normal volume after liftoff.</p> <p>4 Affected crewman's PTT switch is inoperative. In the event of intercom diode switch failure, transmissions to ground are available by returning AUDIO CONT - NORM.</p>
2 LOSS OF INTERCOM (ALL CREWMEN)	<p>1 Backup intercom • INTERCOM (3) - OFF • PAD COMM (3) - T/R Sidetone?</p> <p>2 FLIGHT &amp; POST LANDING BUS FAILED</p> <p>3 Select key mode • UP TLM CMD - RSET then NORM • S BD MODE PCM - KEY • S BD MODE RNG - OFF</p> <p>4 INTERCOM CIRCUIT FAILURE</p>	<p>1 Pwr lost to audio center equip and VHF AM. Capability to xmit and rcv voice via VHF AM, S BD or INTERCOM is lost. Down voice substitute is crew alert light.</p> <p>2 Transmitted signal is not audible in this failure mode.</p> <p>3 No hot mike intercom available. S BD or VHF AM sidetone may also be used as backup intercom.</p>
3 ONE CREWMAN HAS UNSELECTED HOT MIKE CONDITION	<p>1 Audio Center • MODE - PTT • Talk without keying Hear yourself?</p> <p>2 VOX CIRCUIT FAILURE</p> <p>3 Discontinue use of VOX mode</p> <p>4 Audio Center • VHF AM - OFF • Talk without keying Hear yourself?</p> <p>5 VHF A&amp;B COMMON XMTR KEYING CIRCUIT FAILED</p> <p>6 Audio Center VHF AM - RCV • VHF AM (2) - off (ctr) • VHF AM RCV - A NOTE: When VHF transmissions are desired: • VHF AM A or B - SIMPLEX (off ctr to receive)</p> <p>7 Audio Center • VHF AM - T/R • S BD - OFF • Talk without keying Hear yourself?</p> <p>8 S BD ENABLING CIRCUIT SHORTED</p> <p>9 Audio Center • AUDIO CONT - BU • PWR - OFF</p> <p>10 S BD - T/R • Cycle PTT sw on RHC (left or center only) • Talk without keying Hear yourself?</p> <p>11 INTERMITTENT PTT SW ON ROTATION CONTROL</p> <p>12 Discontinue use of affected RHC PTT switch</p> <p>13 Isolate failed components by substitution Affected crewman's Audio Panel: • PWR - OFF • SUIT PWR - OFF • VHF AM - OFF • S BD MODE PCM - PCM or ctr Replace COMM components individually Talk without keying Hear yourself?</p> <p>14 FAILURE OF REPLACED COMPONENT</p> <p>15 AUDIO CENTER OR ROTATION CONTROL PTT SWITCH FAILED</p> <p>16 Audio Center • AUDIO CONT - BU • PWR - OFF • VHF AM - OFF</p>	<p>1 Results in A/G transmissions for all equipment selected to T/R.</p> <p>2 Selecting the alternate Audio Center is necessary to avoid the HOT MIKE conditions and continuous S BD voice transmissions regardless of the position of the Audio Center S BD switch.</p> <p>3 Procedure removes all power from CCU.</p> <p>4 The Audio Center is still usable in the hot mike mode; undesired air-to-ground transmissions can be eliminated by placing the Audio Center S BD and VHF switches to OFF or RCV.</p> <p>5 The PTT sw of affected crewman will be inoperative.</p>

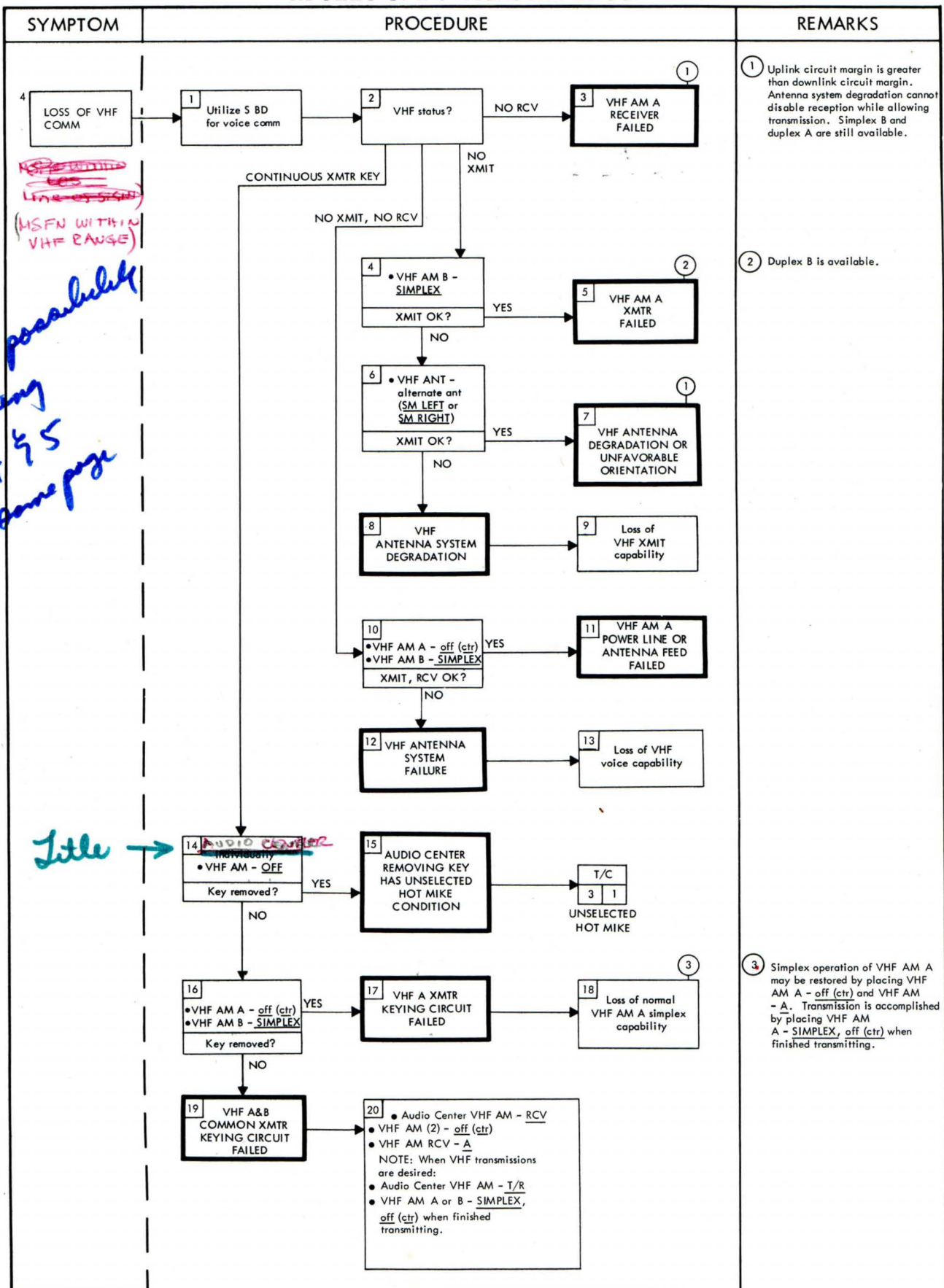
*Don't observe BACKUP*

*Spell out*

*Spell out*



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APOLLO OPERATIONS HANDBOOK



Basic Date \_\_\_\_\_

Change Date \_\_\_\_\_

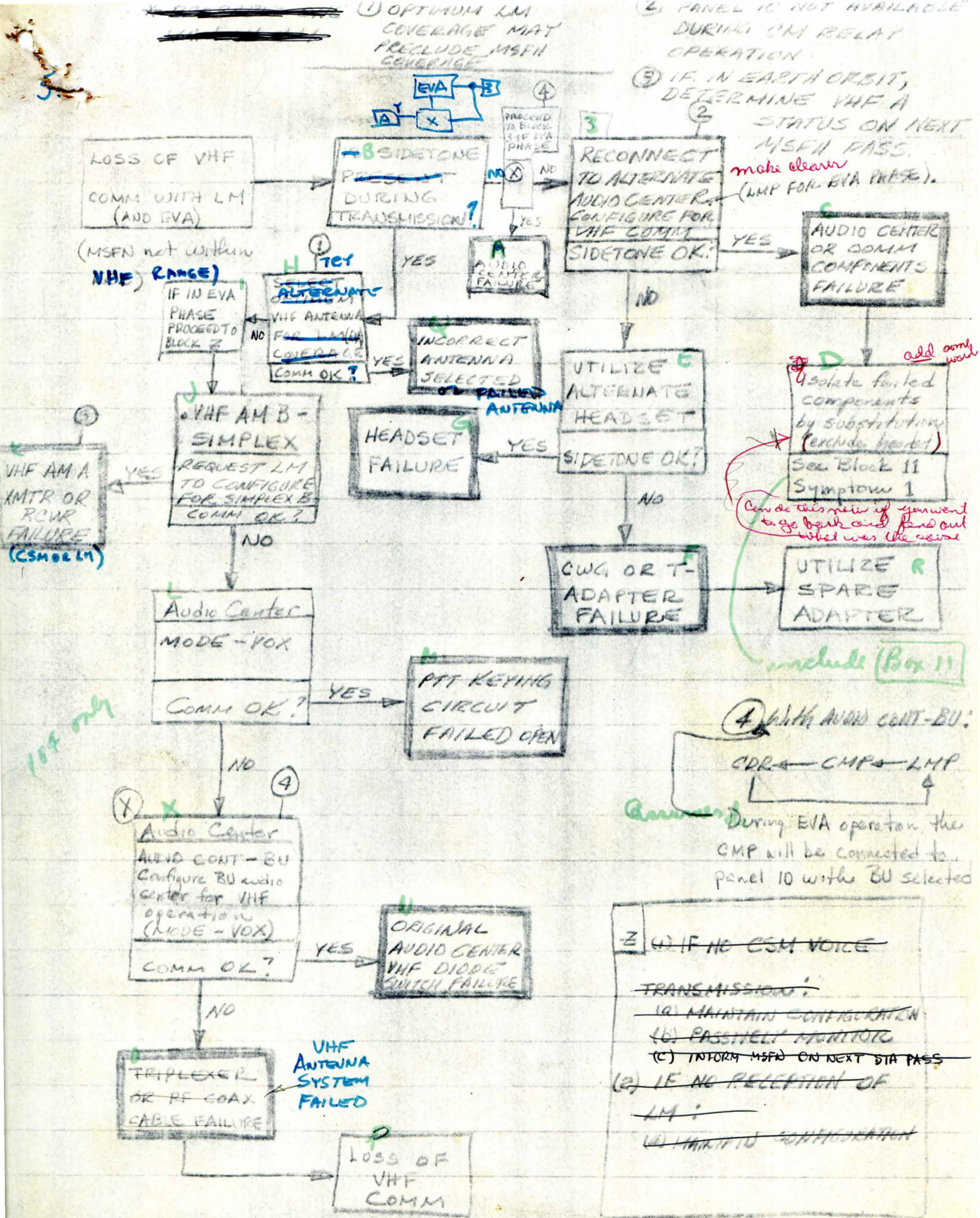
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Look at possibility  
of putting  
4 & 5  
on same page

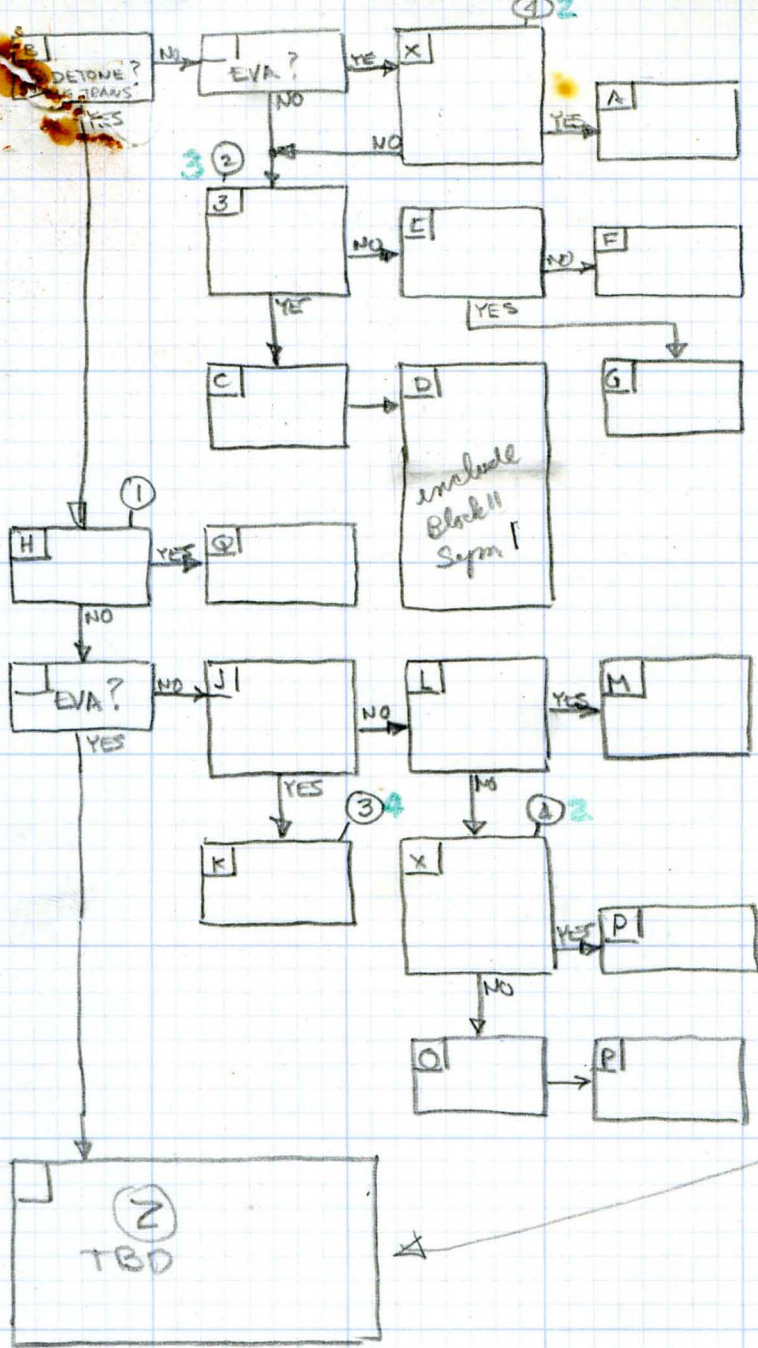
Little →

T/C









- ①
- ②
- ③
- ④

TC #5

109 only

Check —  
 will you add  
 Dave Brooks and  
 resolve this before  
 this gets pushed  
 we can still  
 submit it as a  
 change — with block Z  
 undetermined — and  
 add it in before  
 print

Jack

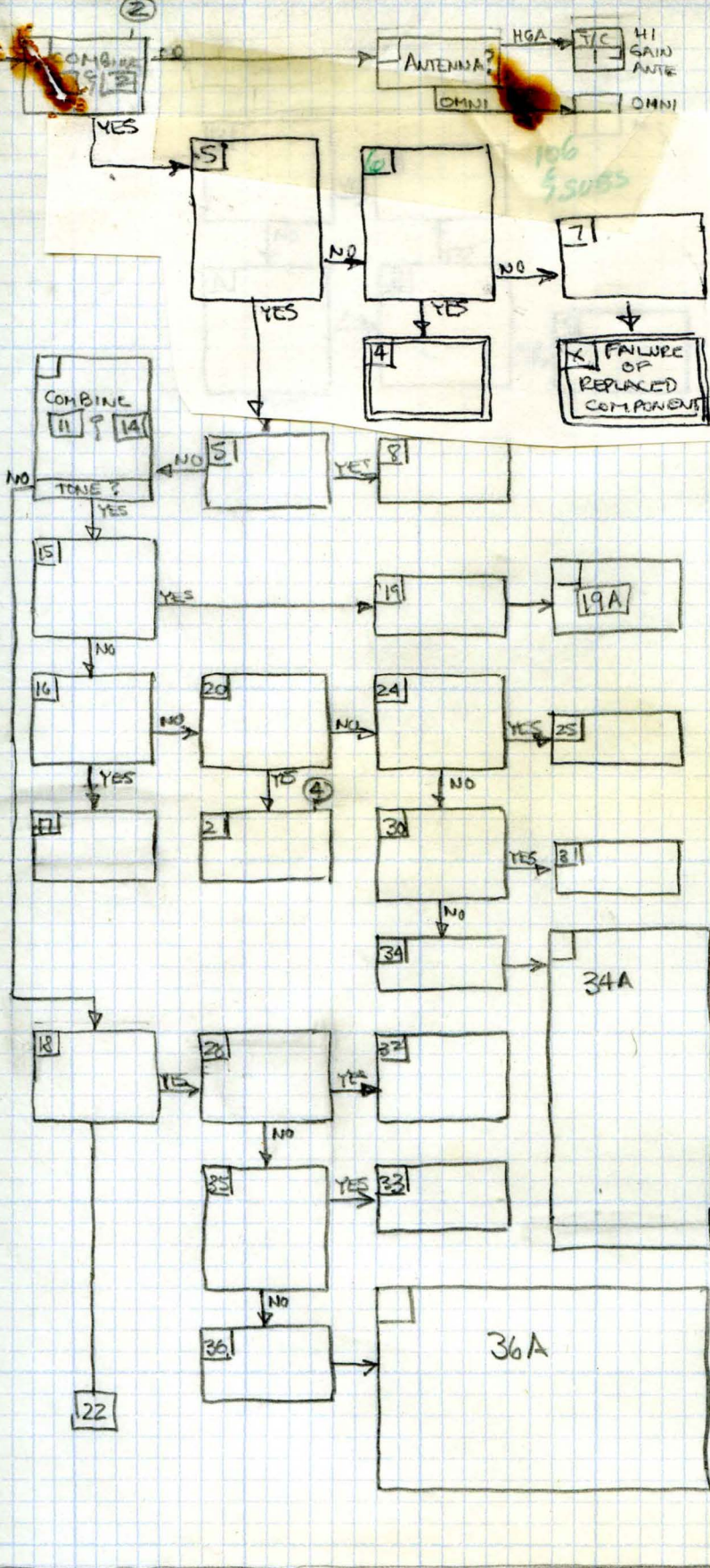


SM2A-03-SC104-(2)  
APOLLO OPERATIONS HANDBOOK

Do we want to use this value as  $6000$

SYMPTOM	PROCEDURE	REMARKS
<b>(MSFN within VHF range)</b>		
① LOSS OF S BD VOICE COMM	<p>Combine IRE YES → NO DN VOICE → NO UP VOICE → NO DPORDN VOICE OR DATA → X ANT? → YES → 3 NORMAL PMP POWER SUPPLY FAILED</p> <p>NO → COMBINE IRE? → YES → 8 PMP PMR AUX → YES → 4 NORMAL PMP POWER SUPPLY FAILED</p> <p>NO → S BAND STATUS? → NO UP VOICE → 9 PMP SHORT COMMON TO BOTH POWER SUPPLIES → 11 Loss of S BD voice and data</p> <p>NO → PCM? → YES → 17 Updata? → NO → 15 S BD XPNDR - redundant xpndr Allow up to 30 sec for phaselock acquisition Up voice &amp; up data ok? → 14 ORIGINAL TRANSPONDER RECEIVER FAILED</p> <p>NO → 12 Down voice B/U • S BD AUX-TAPE - DN VOICE BU • S BD MODE RNG - OFF • PCM BIT RATE - LO → DN voice OK? → YES → 13 PMP VOICE RELAY OR VOICE MODULATOR FAILED</p> <p>NO → 16 PMP VOICE CLIPPER OR AUDIO CENTER S BD OUTPUT FAILED → 18 Loss of S BD down voice capability</p> <p>20 • S BD XPNDR - redundant xpndr Allow up to 30 sec for phaselock acquisition DN voice &amp; PCM ok? → YES → 22 ORIGINAL XPONDER TRANSMITTER FAILED</p> <p>NO → 25 • S BD MODE PCM - off (ctr) → DN voice OK? → YES → 26 PMP PM MIXER FAILED</p> <p>NO → 29 • S BD MODE PCM - PCM • S BD PWR AMPL PRIM - redundant pwr amp → DN voice &amp; PCM ok? → YES → 33 ORIGINAL S BD PWR AMPL FAILED</p> <p>NO → 30 BU PCM down link • S BD AUX TAPE - TAPE • PMP PWR - AUX → 34 Loss of S BD DN voice and PCM</p> <p>23 • UP TLM DATA - UP VOICE BU Up voice ok? → YES → 24 NORMAL UP VOICE DETECTOR FAILED</p> <p>NO → 27 • S BD MODE VOICE - RELAY • INTERCOM (3) - T/R • AUDIO CONT BU - (pnl 10) • MODE - VOX (pnl 9 &amp; 10) Up voice ok? → YES → 28 PMP NORMAL VOICE OUTPUT CIRCUIT FAILURE</p> <p>NO → 31 PMP COMMON VOICE OUTPUT CIRCUIT FAILED → 32 Loss of S BD up voice</p>	<p>① Loss or near loss of upvoice is indicated by noise in headset and S BD ANT ind &lt;60% (approx). Loss of normal downvoice should be anticipated if S BD ANT ind &lt;80% (approx).</p> <p>② Notify MSFN of UP TLM reset action.</p> <p>③ The capability is lost to transmit recorded PCM.</p> <p>④ Loss of capability of simultaneous transmission of down voice and HBR PCM.</p> <p>⑤ Notify MSFN to transmit voice on the up data subcarrier. Backup up voice and up data transmission must be time shared. Action will result in 1-2 KHz tone in headset until MSFN configures for up voice B/U.</p> <p>⑥ Provides an alternate voice circuit, but no PCM capability.</p> <p>⑦ CMP PTT switch will be inoperative. S BD reception will be via intercom bus.</p> <p>⑧ The power amplifier requires a 90 sec warmup period.</p> <p>⑨ S BD AUX TAPE - TAPE activates the FM transmitter and the alternate power amplifier which requires a 90 sec warmup period. It is crew option to transmit real time PCM, recorded data, or TV via the FM transmitter.</p> <p>⑩ With one of the power amplifiers failed the capability is lost to transmit FM (recorded data or TV) simultaneously with PM transmission of real time PCM and voice.</p>





1

2

OLD  
COMM # 6

new Comm  
# 7

1



A	AUDIO CENTER
	• SBD - T/R
	• VHF, PADCOMM, INTERCOMM $\rightarrow$ <u>OFF</u>
	SIDETONE ?

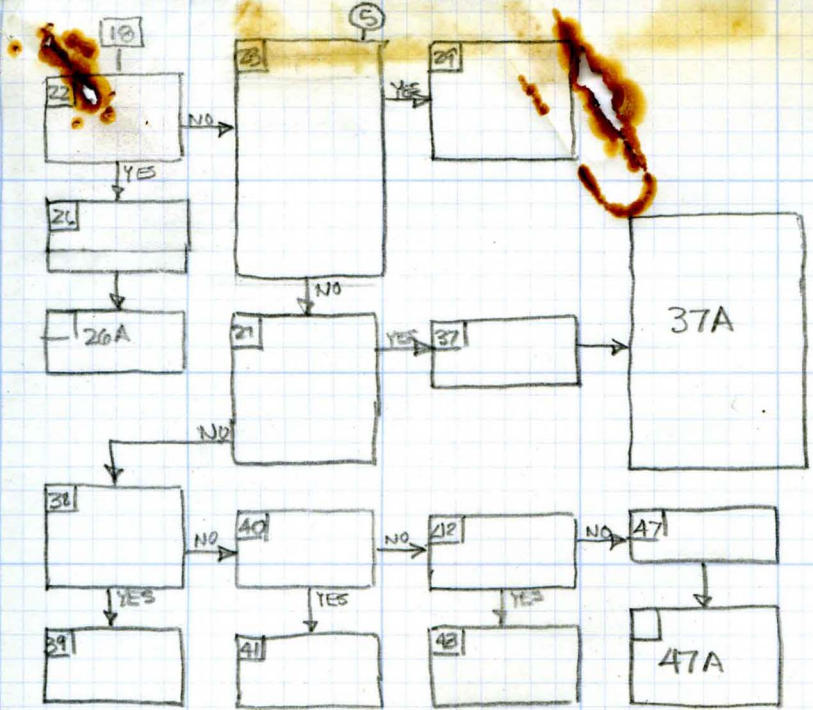
Bores added  
to  
old  
Comm #6

B	
	• AUDIO CENTER - <u>BACKUP</u>
	ALT AUDIO CENTER
	• - <u>VOX</u>
	• SBD - T/R
	SIDETONE ?

D	ORIG
	AUDIO CENTER
	FAILED

C	ISOLATE
	CCU, T-ADAPTER
	AND HEADSET
	BY SUBSTITUTION

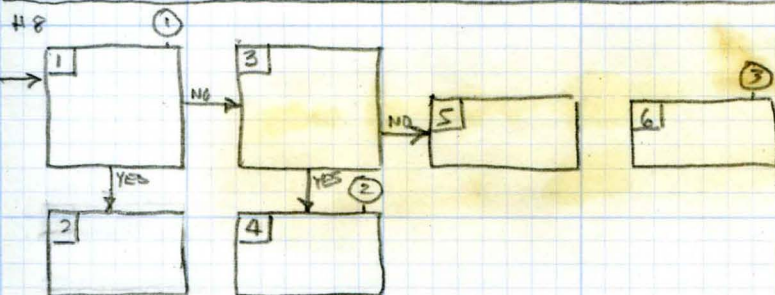




OLD  
COMM  
#6 (page 2)

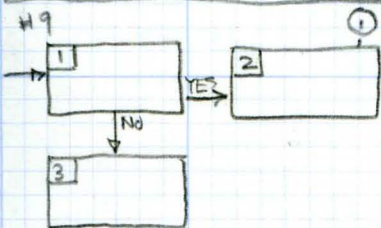
NEW  
#7

LAYOUT  
FOR COMM  
PAGE 6



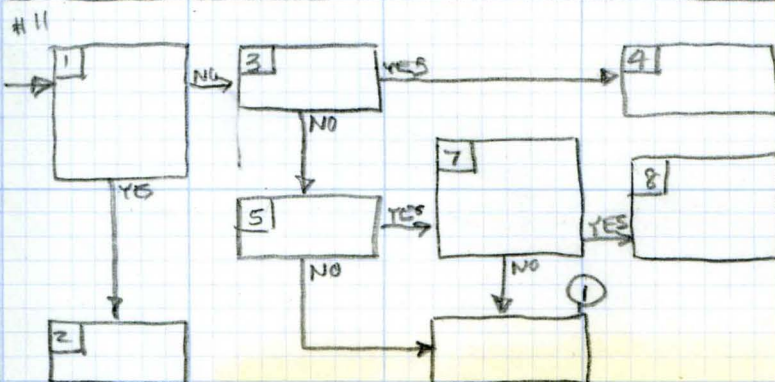
OLD  
COMM  
#8

NEW  
#8



OLD  
COMM  
#9

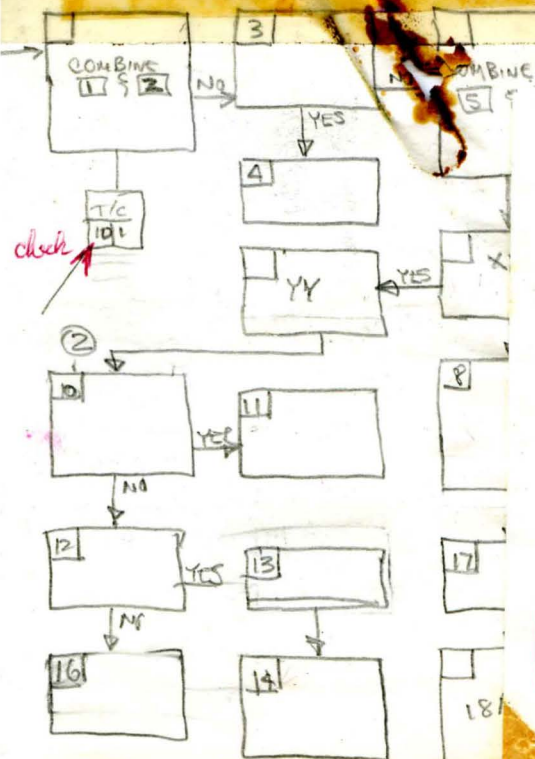
NEW  
#9



OLD  
COMM  
#11

NEW  
#10





**XX Sel omni ant**

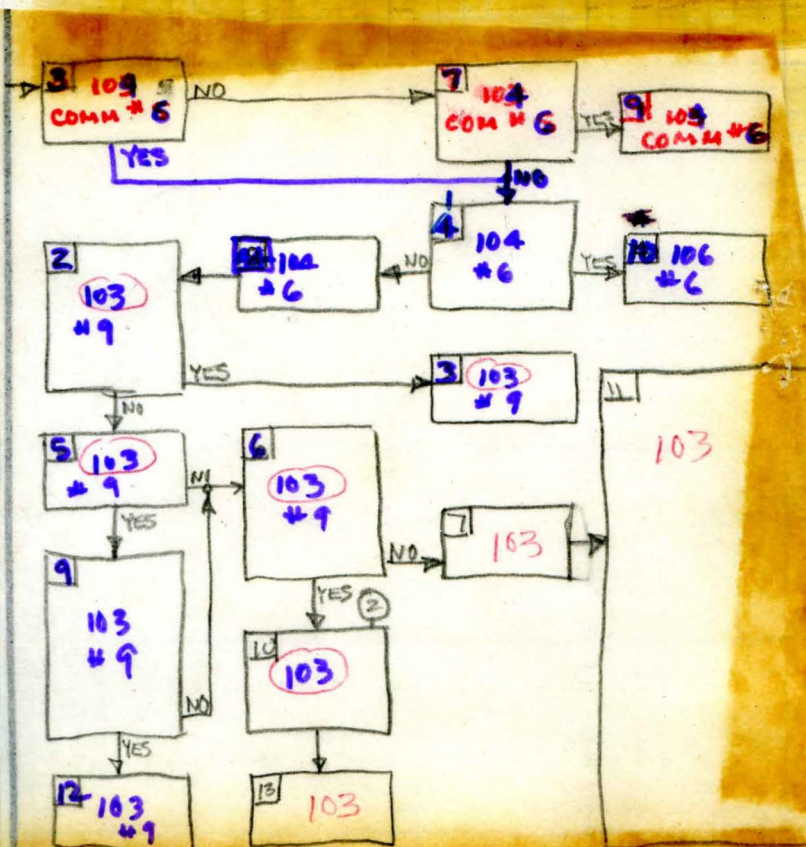
- Select favorable omni antenna
- V64 E (if necessary)

**Phaselock acquired?**

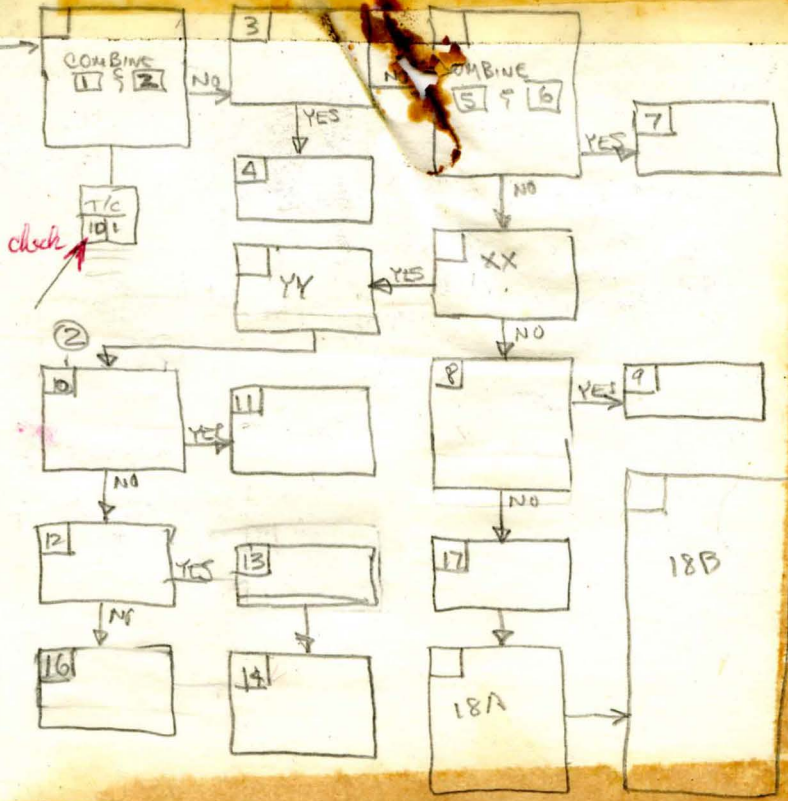
**YY**

- Restore Voice Comm
- then
- Revert HI GAIN ANT.

(over)



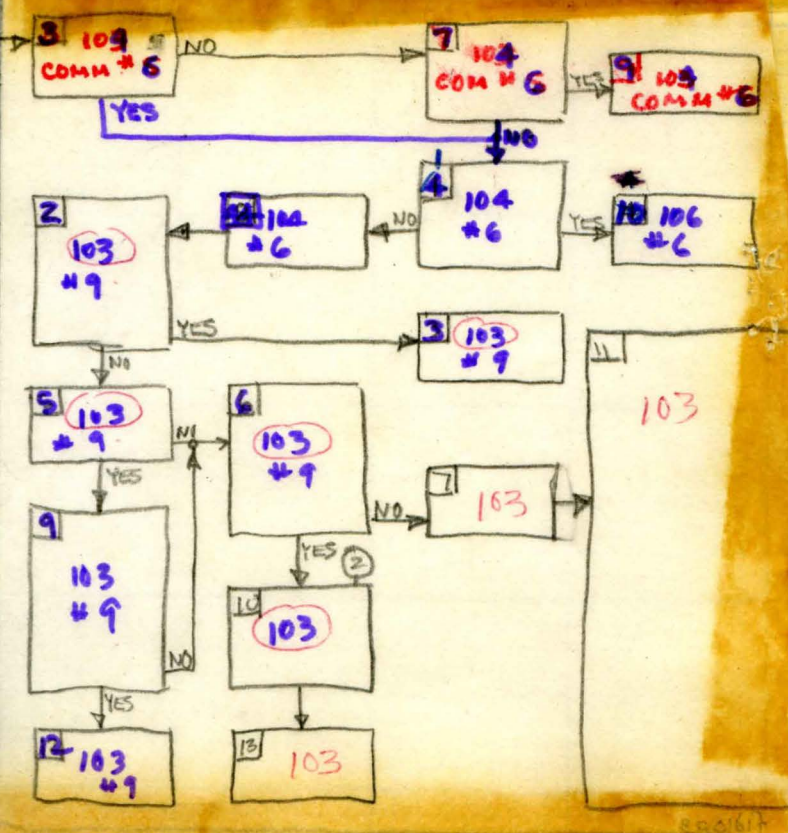




OLD  
COMM  
# 12

NEW  
COMM  
# 11

- 44 Restore Voice Comm
- PCM BIT RATE - LOW
  - SBD AUX TAPE - IN VOICE BU
  - SBD MODE RNG - RNC
  - Restart Voice Control
  - Reset HI GAIN ANT



OLD  
COMM # 10

NEW  
COMM # 12

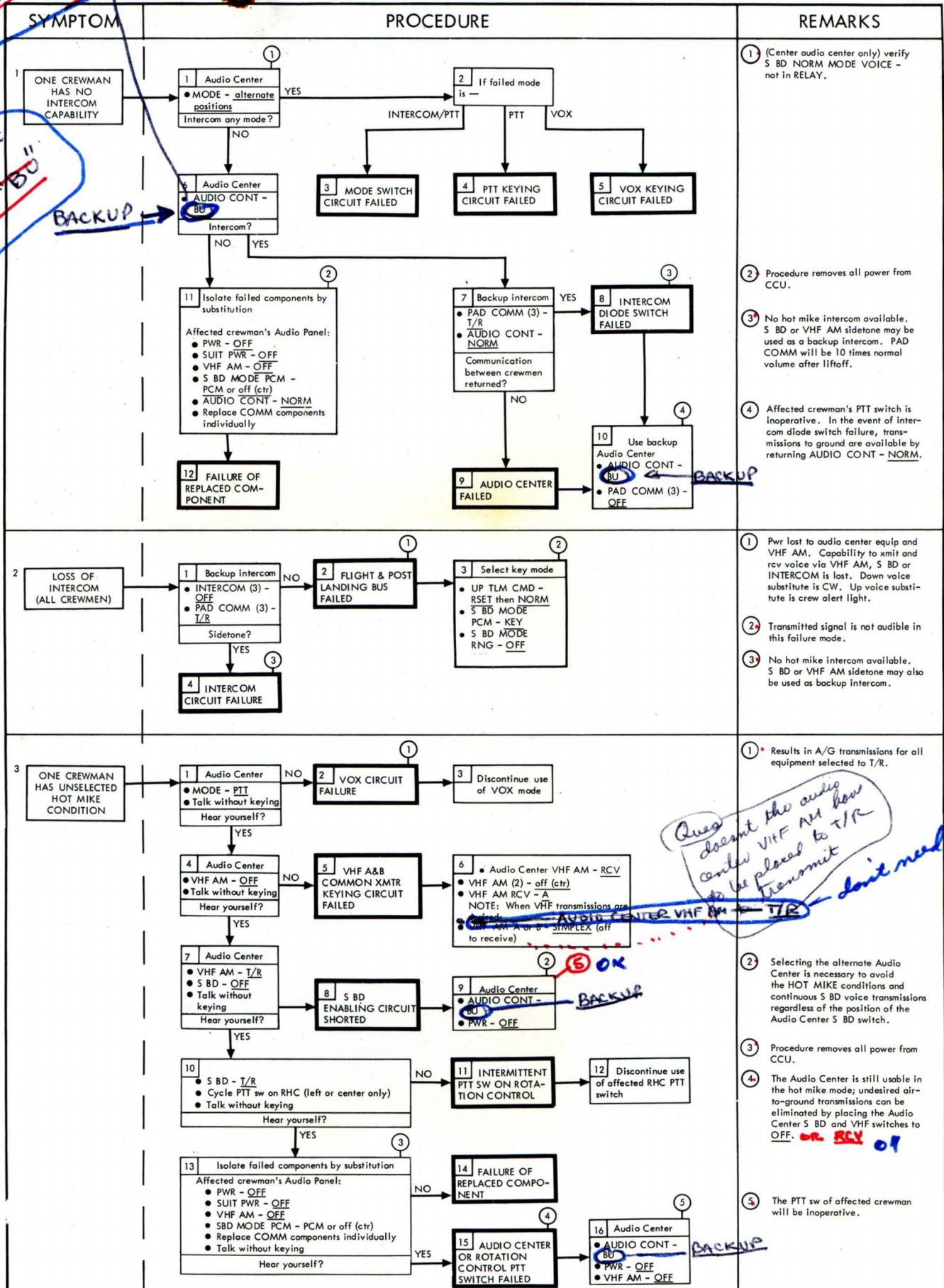


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SYMPTOM	PROCEDURE	REMARKS
<p>10 11 12</p> <p>HI GAIN ANTENNA DOES NOT RESPOND PROPERLY TO POINTING COMMANDS</p> <p><i>except layout</i></p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>18A</p> <p>18B</p> <p>HI GAIN ANTENNA DOES NOT RESPOND PROPERLY TO POINTING CMD</p> <p>1. Assume that earth LOS is not within shadow area</p> <p>2. HGA respond properly to manual pointing commands?</p> <p>3. UP TLM CMD - RSET then NORM</p> <p>4. INADVERTENT RTC RELAY OPERATION</p> <p>5. Wait 5 min for possible MSFN problem</p> <p>6. HI GAIN ANT SERVO ELEC - redundant elec</p> <p>7. ORIGINAL HGA SERVO ELECTRONICS FAILED</p> <p>8. S BD XPNDR - redundant xpndr</p> <p>9. ORIGINAL XPNDR FAILED</p> <p>10. HI GAIN ANT BEAM - WIDE or NARROW (alternate position)</p> <p>11. MICROWAVE WIDE OR NARROW TRACKING CIRCUITRY FAILED</p> <p>12. Can phaselock be acquired in manual?</p> <p>13. AUTO TRACK CIRCUITRY FAILED</p> <p>14. Utilize omni antennas or Utilize HGA in manual mode</p> <p>15. S BD ANT sws - select appropriate omni</p> <p>16. HGA MICROWAVE ELECTRONICS FAILED</p> <p>17. TRIPLEXER OR RF COAX CABLE FAILED</p> <p>18. Loss of uplink voice comm. Possible loss of downlink voice comm.</p> <p>18A</p> <p>18B</p> <p>SBD MODE VOICE - OFF</p>	<p>1</p> <p>Indicators will display actual antenna position. If look angle is outside shadow area HGA may be utilized when CSM attitude permits.</p> <p>2</p> <p>Loss of uplink phaselock is indicated by noise in headset and S-BD antenna ind &lt;30%.</p> <p>3</p> <p>If in medium select wide.</p>



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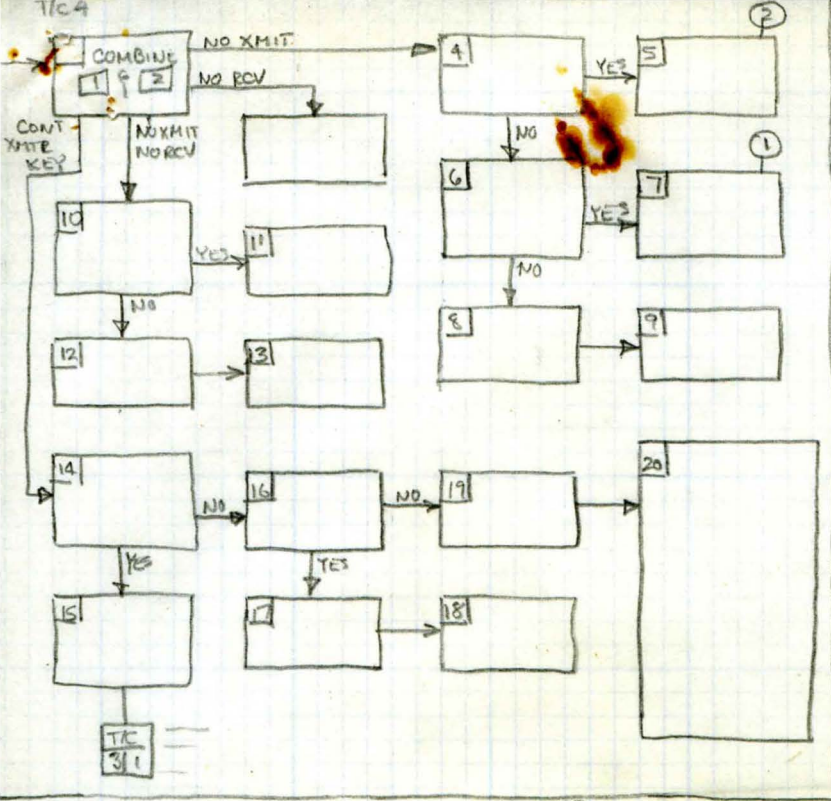


Basic Date

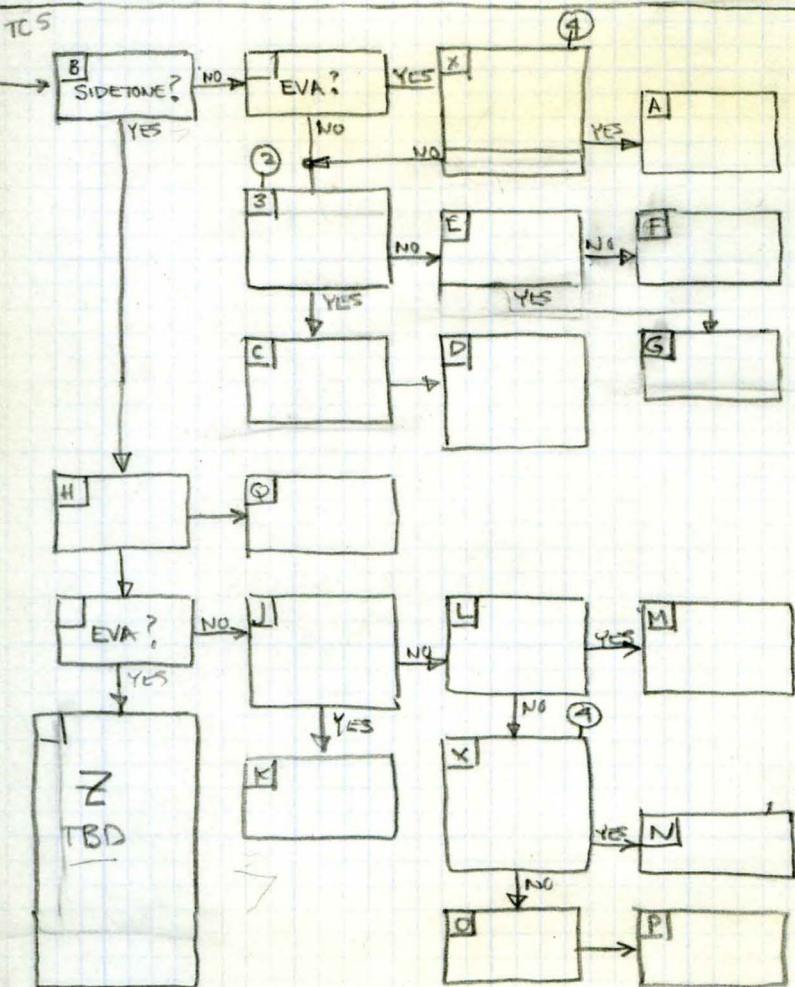
Change Date

Page





Solve  
This place  
with VHF  
procedures  
on same page





Needs work

# SYMPTOM

5 LOSS OF VHF COMM WITH LM  
(MSFN not within 100 VHF range)

not same name as in 1

See new procedure -  
(combined Proc 4 & 5)

4 LOSS OF VHF COMM WITH MSFN  
MSFN NOT WITHIN LOS

17 Problem is in other crewman's Audio Center

18 • Audio Center  
• VHF AM (3) - T/R  
• VHF AM A - off (ctr)  
• VHF AM RCV - A  
Rushing noise heard?

23 • VHF AM B - SIMPLEX  
• VHF AM SQLCH B tw - 1  
Rushing noise heard?

24 VHF AM A RCVR FAILED

25 • VHF AM A - SIMPLEX  
• Instruct LM to configure for VHF AM B SIMPLEX  
• VHF AM A - off (ctr)

LOSS OF VHF COMM WITH MSFN

1 NO XMIT, NO RCV  
NO XMIT  
NO RCV

104 4 104 4 104 4 104 4

CONT XMIT KEY

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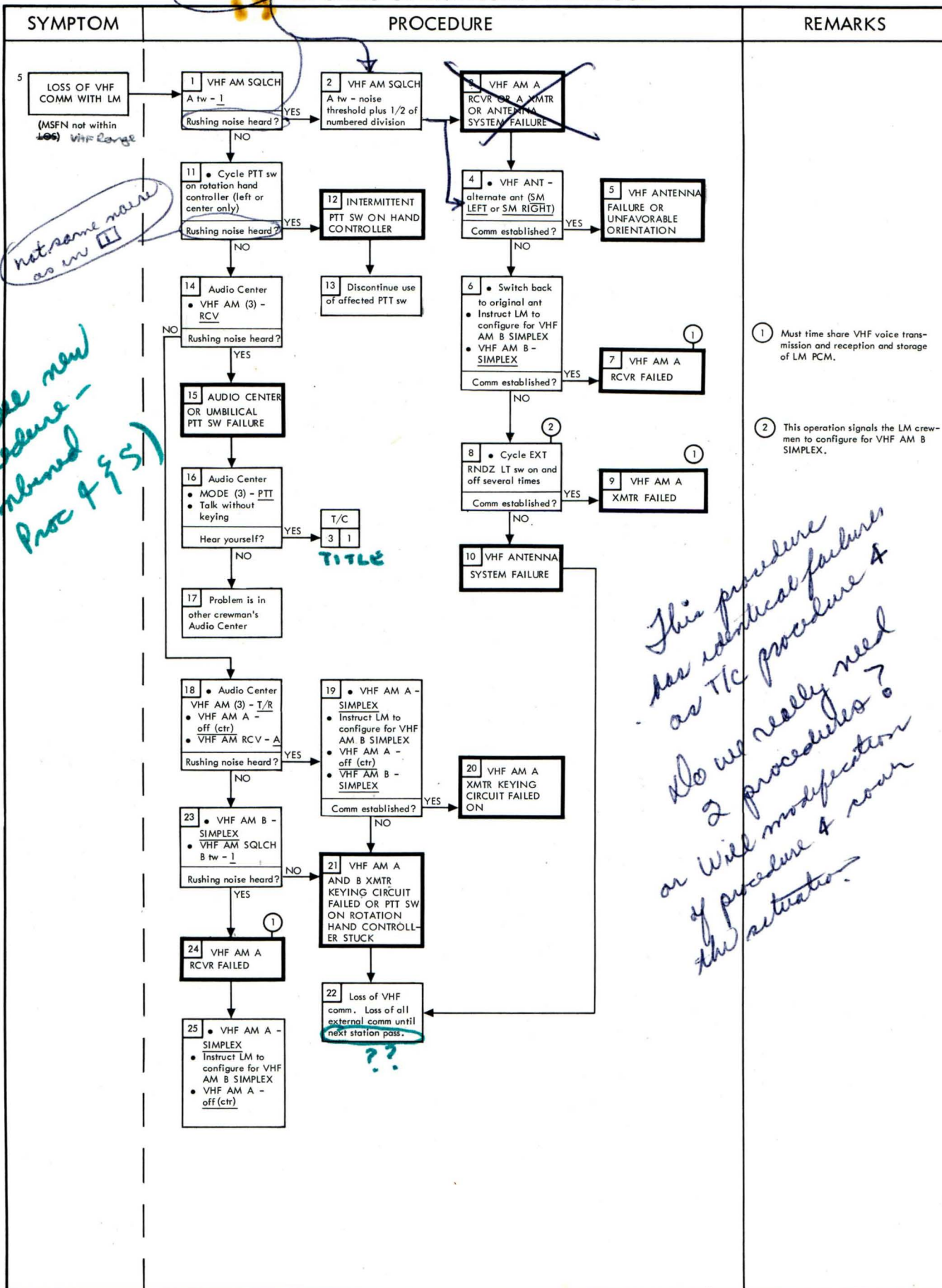
old procedures not valid after 1/24/69 meeting



*Needs work*

*This wording confuses me*

SM2A-03-SC104-(2)  
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*See new procedure - (combined Proc 4 & 5)*

*not same name as in [ ]*

*This procedure has identical failures as T/C procedure & also we really need 2 procedures or will modification of procedure & cover the situation.*



## APOLLO OPERATIONS HANDBOOK

[illegible]



SM2A-03-SC104-(2)  
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>6 (Cont)</p> <p>UP TLM CM → ACCEPT</p>	<pre> graph TD     27[27] -- YES --&gt; 37[37]     27 -- NO --&gt; 38[38]     37 --&gt; 4[4]     38 --&gt; 39[39]     38 --&gt; 40[40]     39 --&gt; 43[43]     40 --&gt; 41[41]     40 --&gt; 42[42]     41 --&gt; 43     42 --&gt; 43     42 --&gt; 46[46]     43 --&gt; 47[47]     46 --&gt; 45[45]     46 --&gt; 49[49]     45 --&gt; 48[48]     45 --&gt; 46     47 --&gt; 50[50]     47 --&gt; 51[51]     50 --&gt; 51     4 --&gt; 44[44]     44 --&gt; 45     </pre> <p><b>37 LOSS OF S BD UP VOICE CAPABILITY</b>          • UP TLM CM → ACCEPT          • GROUND WILL COMMUNICATE BY MORSE CODE DISPLAYED ON DSKY AS FOLLOWS:          ONE CHARACTER PER REGISTER          DASH = 1          DOT = 0          FILL = 9</p> <p><b>38 S BD AUX TAPE - DN VOICE BU</b>          Voice comm? YES → 39          NO → 40</p> <p><b>39 S BD AUX - TAPE OR OFF SW POSITION SHORTED</b></p> <p><b>40 S BD AUX TV - SCI</b>          Voice comm? YES → 41          NO → 42</p> <p><b>41 S BD AUX - TV OR OFF SW POSITION SHORTED</b></p> <p><b>42 S BD AUX TAPE - TAPE</b>          Voice comm? YES → 43          NO → 46</p> <p><b>43 S BD AUX - OFF SW OR DN VOICE BU POSITION SHORTED</b></p> <p><b>44 Wait 5 min for possible MSFN problem</b></p> <p><b>45 S BD XPNDR - redundant xpndr</b>          ANT ind &gt; 60%? YES → 48          NO → 46</p> <p><b>46 Orient CSM for HGA (or omni if HGA originally selected)</b>          • Select appropriate antenna          ANT ind &gt; 60%? YES → 49          NO → 47</p> <p><b>47 LOSS OF PMP</b>          • CONFIGURE FOR TV AND USE CUE CARDS FOR DOWNLINK          UP COMM PER STEP 36</p> <p><b>48 ORIGINAL XPNDR FAILED</b></p> <p><b>49 ORIGINAL ANTENNA OR 2 KMC COAX SW FAILED</b></p> <p><b>50 TRIPLEXER OR RF COAX CABLE FAILED</b></p> <p><b>51 Loss of uplink voice comm.</b>          Possible loss of downlink voice comm.          • PCM BIT RATE - LO          • S BD AUX TAPE - DN VOICE BU          • S BD MODE RNG - RNG          Continue optimum ant switching          Attempt voice comm at least once per hour on the GET hour as follows:          • S BD MODE PCM - off (ctr)          • PCM BIT RATE - HI          • S BD RNG - OFF          • Perform comm check          If no contact          • S BD MODE PCM - PCM          • PCM BIT RATE - LO          • S BD MODE RNG - RNG          • Attempt DSE dump of recorded voice          At completion of dump          • S BD AUX TAPE - DN VOICE BU          When range &lt; 60K NM          • VHF AM A - SIMPLEX          • Audio center VHF AM - T/R          • Standby for MSFN call</p>	<p>NR → Probably will not be able to get TV if this failure is too PMP power supplies</p> <p>PMP FAILED</p> <p>47A</p> <p>If not, w is this fail</p>



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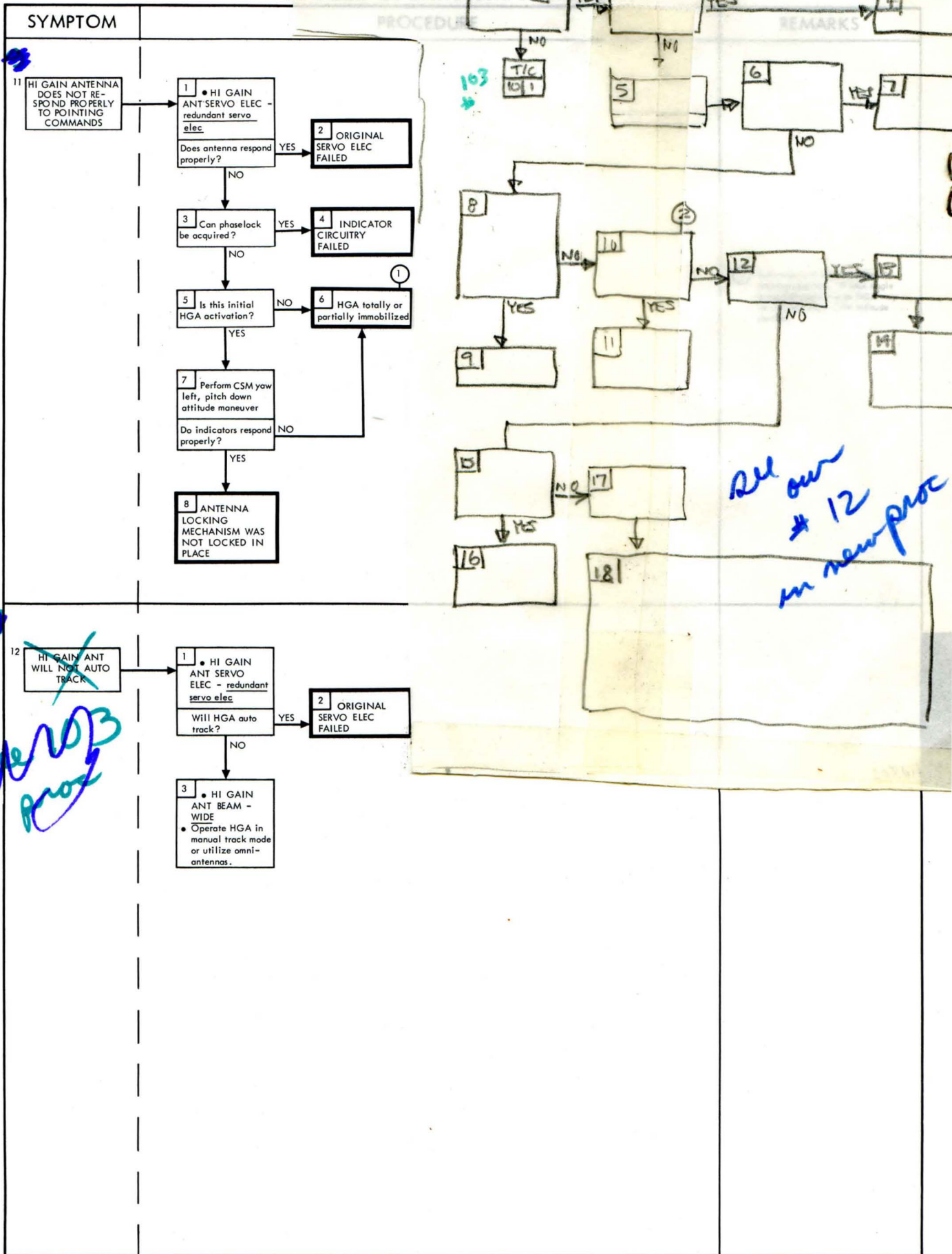
SYMPTOM	PROCEDURE	REMARKS
7 (Cont)	<pre> graph TD     6[6] -- NO --&gt; 35     35["35 • UP TLM CMD - RESET then NORM Ant ind &gt; 60% ?"] -- YES --&gt; 36["36 INADVERTENT RTC RELAY OPERATION"]     35 -- NO --&gt; 37     37["37 • S BD XPNDR - redundant xpndr Ant ind &gt; 60% ?"] -- YES --&gt; 38["38 ORIGINAL XPNDR FAILED"]     37 -- NO --&gt; 39     39["39 Orient S/C for hga (or omni if hga originally selected) • Select appropriate antenna Ant ind &gt; 60% ?"] -- YES --&gt; 40["40 ORIGINAL ANTENNA OR 2 KMC COAX SW FAILED"]     39 -- NO --&gt; 41     41["41 TRIPLEXER OR RF COAX CABLE FAILED"]     41 --&gt; 42     42["42 Loss of uplink voice comm. Possible loss of downlink voice comm. • PCM BIT RATE - LO • S BD AUX TAPE - DN VOICE BU • S BD MODE RNG - RNG  Continue optimum ant switching. Attempt voice comm at least once per hour on the GET hour as follows: • S BD MODE PCM - ctr • PCM BIT RATE - HI • S BD MODE RNG - OFF • Perform comm check  If no contact - • S BD MODE PCM - PCM • PCM BIT RATE - LO • S BD MODE RNG - RNG • Attempt DSE dump of recorded voice  At completion of dump - • S BD AUX TAPE - DN VOICE BU  When range &lt; 60 KNM • VHF AM A - SIMPLEX • Audio Center VHF AM - T/R • Standby for MSFN call"]                     </pre>	

T/C



ALL NUMBERS & NOT  
REFER TO 103 -  
PROCEDURES

COMM  
11  
HGA





SM2A-03-SC104-(2)  
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>11 HI GAIN ANTENNA DOES NOT RESPOND PROPERLY TO POINTING COMMANDS</p>	<pre> graph TD     1["1 • HI GAIN ANT SERVO ELEC - redundant servo elec"] --&gt; Q1{Does antenna respond properly?}     Q1 -- YES --&gt; 2["2 ORIGINAL SERVO ELEC FAILED"]     Q1 -- NO --&gt; 3["3 Can phaselock be acquired?"]     3 -- YES --&gt; 4["4 INDICATOR CIRCUITRY FAILED"]     3 -- NO --&gt; 5["5 Is this initial HGA activation?"]     5 -- NO --&gt; 6["6 HGA totally or partially immobilized"]     5 -- YES --&gt; 7["7 Perform CSM yaw left, pitch down attitude maneuver"]     7 --&gt; Q2{Do indicators respond properly?}     Q2 -- NO --&gt; 6     Q2 -- YES --&gt; 8["8 ANTENNA LOCKING MECHANISM WAS NOT LOCKED IN PLACE"]         </pre>	<p>① Indicators will display actual antenna position. If look angle is outside shadow area HGA may be utilized when CSM attitude permits.</p>
<p>12 HI GAIN ANT WILL NOT AUTO TRACK</p>	<pre> graph TD     1["1 • HI GAIN ANT SERVO ELEC - redundant servo elec"] --&gt; Q1{Will HGA auto track?}     Q1 -- YES --&gt; 2["2 ORIGINAL SERVO ELEC FAILED"]     Q1 -- NO --&gt; 3["3 • HI GAIN ANT BEAM - WIDE • Operate HGA in manual track mode or utilize omni-antennas."]         </pre>	

SM-2A-1964

Basic Date \_\_\_\_\_

Change Date \_\_\_\_\_

Page \_\_\_\_\_